Acquiring data in real time in Italy from Antarctic Seismographic Argentinean Italian Network (ASAIN): testing the global capabilities of EarthWorm and Antelope software suites

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Abstract

The Italian National Institute for Oceanography and Experimental Geophysics-OGS is running the Antarctic Seismographic Argentinean Italian Network (ASAIN), made of 7 seismic stations located in Antarctica and Tierra del Fuego (TdF) - Argentina: data from these stations are transferred in real time to the OGS in Trieste (Italy) via satellite links provided by the Dirección Nacional del Antártico (DNA) - Instituto Antártico Argentino (IAA) and the Estación Astronómica Río Grande (TdF). Data is collected and archived primarily in Güralp Compress Format (GCF) through the Scream! software at OGS and DNA-IAA, and transmitted also in real time to the Observatories and Research Facilities for European Seismology (ORFEUS). The main real time data acquisition and processing system of the ASAIN network is based on the EarthWorm software installed on a Linux server at the OGS in Trieste. It runs several modules for data collection, archiving, publication on dedicated wave servers: wave_serverV and Winston Wave Server (WWS), data analysis and realtime monitoring through Swarm software. OGS is also running, in cooperation with the Friuli-Venezia Giulia Civil Defense, the North-East Italy (NI) network, making use of the Antelope as the main system.

To check the global capabilities of the Antelope, we also set up the data acquisition in real time from both ASAIN and a subset of the Global Seismic Network (GSN) funded by the Incorporated Research Institution for Seismology (IRIS). The facilities of the IRIS, were used for real time access to waveform required in this study. The first tests indicated that more than 80% of the earthquakes with M>5.0 listed in the Preliminary Determination of Epicenters (PDE) catalogue of the United States Geological Survey (USGS) were also automatically located by Antelope, with an average error of 0.05° and average body wave magnitude Mb estimation error below 0.1. These results indicate that Antelope is suitable for regional and global early warning systems.

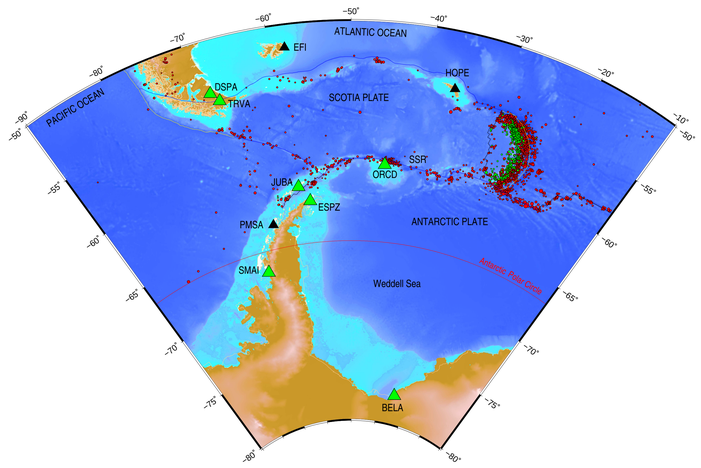

FIGURE 1: Antarctic seismological station location of ASAIN and GSN networks. Green triangles: Asain stations - Black triangles: GSN stations. Seismicity from NEIC Catalog 1973-2009, red circles Eq depth less than 60 km and green circles between 60 and 300 km. Bathymetry from General Bathymetric Chart of the Oceans - GEBCO_08.Grid a global 30 arc-second grid.

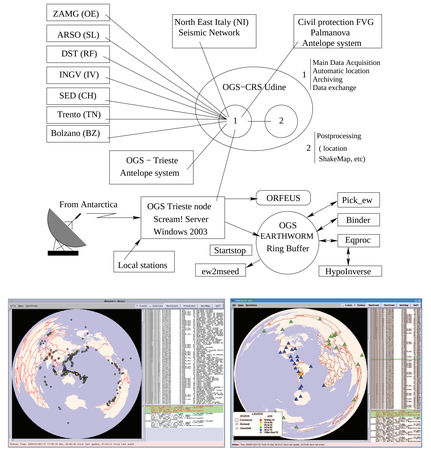

FIGURE 2: The Antelope software is used at OGS as the main data acquisition tool in the northeast Italy (NI). Data are acquired in real time also from neighboring networks in Italy, Switzerland, Austria, and Slovenia for a total of 95 stations. An instance of Antelope has been set up to acquire data in real time of the antarctic ASAIN Network through the Scream! server, this also send data to the EartWorm for postprocessing and archiving in miniSEED format.

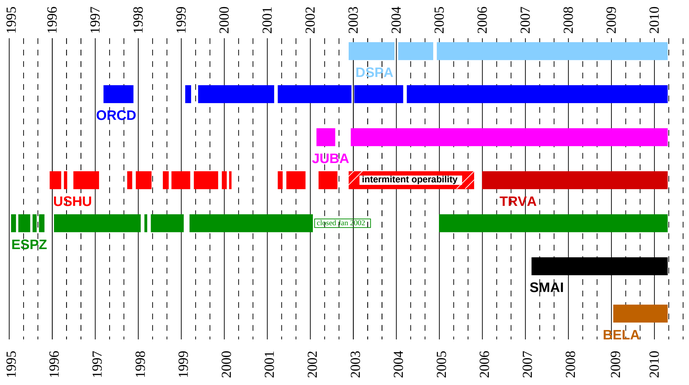

FIGURE 3: Overall perfomance of the ASAIN Network since 1995. From 2003, all ASAIN 20 and 2 samples/s data channels are transmitted in real-time to the OGS server. Each night the complete 40, 20, and 2 sample/s ASAIN data set, recorded during the previous 24 hours, is retransmitted to the OGS server to eliminate possible gaps in the real-time data

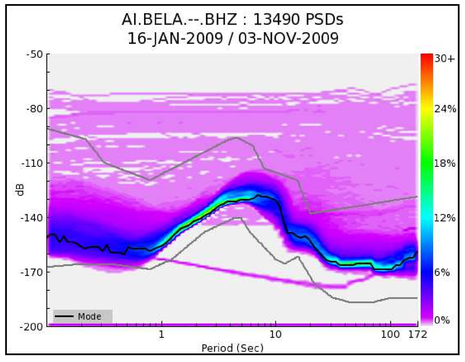

FIGURE 4: Probability Density Functions (PDF), (McNamara D. E. & Boaz R. I., 2005), for BELA at Belgrano II (77° 52' S, 34° 37' W) - Antarctica. PQLX (PASSCAL Quick Look eXtended) is open-source software for evaluating seismic station perfomance and data quality. Given waveform data and instrument response files, PQLX server calculates trace statistics, Power Spectral Densities (PSD), PDF and writes to a MySQL database for quick access.

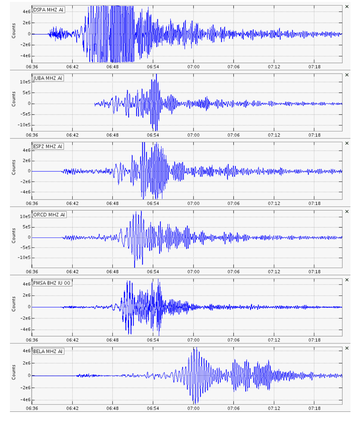

FIGURE 5: ASAIN records of Chile Earthquake Magnitude 8.8 - Offshore Maule Chile, 2010 February 27 06:34:14 UTC, obtained with the Seismic Wave Analysis Real-Time Monitoring - SWARM software connected to EarthWorm system through Winston Wave Server (WWS).

OGS - http://www.ogs.trieste.it
DNA-IAA - http://www.dna.gov.ar
ORFEUS - http://www.orfeus-eu.org
IRIS - http://www.iris.edu - PQLX software - http://www.iris.edu/software/pqlx
USGS - http://www.usgs.gov
Antelope Software - http://www.brtt.com
EarthWorm Software - http://www.isti.com - http://folkworm.ceri.memphis.edu/ew-dist
THE GENERIC MAPPING TOOLS - GMT - http://gmt.soest.hawaii.edu
Seismic Wave Analysis Real-Time Monitoring - SWARM software

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McNamara, D. E., Boaz R. I., 2005. Seismic Noise Analysis System, Power Spectral Density Probability Density Function: Stand-Alone Software Package, USGS Open File Report, 2005-1438, 30 p.

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